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## **Physiotherapy and Speech and Language Therapy Intervention for Chronic Cough**

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**Abstract**

There are few effective pharmacological therapies available to treat refractory chronic cough. Functional MRI studies of the brain have recently shown that patients with chronic cough have dysfunctional inhibitory control of cough. Self-management therapies delivered by physiotherapists or speech therapists are effective at suppressing cough. They enable patients to consciously suppress the urge to cough. The intervention consists of education, laryngeal hygiene, cough suppression and distraction measures and behaviour modification. The efficacy of Physiotherapy and Speech And Language Intervention (PSALTI) has been confirmed in two randomised control trials. In one trial, there was a 41% reduction in cough frequency with PSALTI, assessed objectively with the Leicester Cough Monitor, and a clinically significant improvement in quality of life. Importantly, the improvement in cough was sustained when therapy was discontinued. The addition of the Speech Pathology Treatment to neuromodulator drug therapy, Pregabalin has also been evaluated in a clinical trial. There was a clinically significant improvement in quality of life, and this was sustained when therapy was discontinued. The mechanism of action of PSALTI is not known and this should be investigated in future. Further studies are needed to identify the components of PSALTI that deliver the most benefit, and determine whether PSALTI is effective in cough associated with other chronic lung disorders.

**Keywords:** Cough hypersensitivity syndrome, chronic cough, Physiotherapy, Speech and Language therapy, PSALTI.

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## **1. Cough Hypersensitivity Syndrome and dysfunctional inhibitory control**

Chronic cough is defined as a cough persisting greater than eight weeks but in the specialist clinic setting, most patients have lived with this disorder for many years [1]. Adverse symptoms associated with cough are common such as urinary incontinence, syncope, chest pain and interference with speech [2,3]. Patients with chronic cough have a poor quality of life and often avoid social situations in which they feel embarrassed [4]. Chronic cough is thought to be a disorder of dysregulated sensory nerves that convey information about the air we breathe in to the brain, such as changes in temperature, humidity and the presence of airway irritants [5]. Patients are hypersensitive to airway irritants and this can be demonstrated in the laboratory with the Cough Challenge Test [6]. Capsaicin, the extract of chilli pepper is the most widely used tussive agent in such tests. The term “Cough Hypersensitivity Syndrome” (CHS) for chronic cough disorders has been proposed by the European Respiratory Society taskforce [7]. It is likely that this term encompasses patients with refractory, idiopathic and unexplained chronic cough. The activation of airway sensory nerves in CHS often results in a sensation called the urge to cough [8]. This can lead to a brain stem mediated reflex cough but, more often, it is processed in higher brain centres where it can be modulated to consciously suppress it or to generate a cough to relieve the urge [5]. An important recent finding is that patients are less able to suppress their cough; functional MRI imaging studies have shown reduced activity in the descending cortical motor inhibitory pathways [9].

There are few drug treatments available for patients with CHS [10]. Neuromodulator drugs such as Gabapentin, Pregabalin and Amitriptyline are effective in some patients [2,11–13]. It is likely that their mechanism of action is in the central nervous system and the side effects

also reflect this, such as drowsiness. There is a need for alternative therapeutic approaches. In a recent survey conducted by the European Lung Foundation, many patients expressed the need for self-management interventions [14]. PSALTI has long been used to treat patients with chronic cough [15,16]. They consist of multiple components delivered in sessions by a therapist [17]. They include helping the patient to be in control of their cough, use cough suppression techniques and behaviour modification and relaxation therapies. This article reviews the emerging evidence for PSALTI for patients with CHS.

## **2. PSALTI Components**

The components of PSALTI have been reviewed in detail elsewhere and summarised in Table 1 [18]. Briefly, the therapy starts by educating patients about chronic cough and the concept of cough reflex hypersensitivity. Patients are informed about their ability to consciously control cough, and also the negative effects of repeated coughing. They are then taught cough suppression and distraction techniques, such as forced swallowing, sipping water and sucking sweets. They are asked to identify the triggers of their cough and the urge to cough, so they apply the cough suppression methods in these specific situations. Dysfunctional breathing patterns are common in CHS. These patients generally adopt a mouth breathing pattern which we believe is a significant influencing factor in CHS. Furthermore, vocal cord dysfunction (VCD) can also coexist in CHS and can be demonstrated objectively by visualising the vocal cords under conditions designed to reveal abnormal movements [19]. Therefore, breathing pattern retraining and vocal cord exercises are thought to be an important component of cough management. Psycho-educational counselling is used to motivate patients, and to modify behaviour to reduce an over-

awareness of the need to cough. Lastly, interventions that relieve stress and anxiety are recommended where appropriate.

The optimal number of sessions of therapy, their duration and frequency are not known. In clinical trials, four sessions of therapy have been delivered over one or two months [18,20]. The duration of sessions in one trial were initially one hour, followed by 30-45 minutes for subsequent sessions. Whilst PSALTI is a standardised therapy, it has the flexibility to be individually tailored to the patient's needs. It is important that therapists receive training to be able to deliver effective therapy. The delivery of PSALTI can be facilitated by the use of written treatment plans and educational material [18].

## **2.1 The Evidence**

In 2006, Vertigan *et al* [20] was the first to demonstrate that speech therapy was effective at reducing cough in a single specialist centre randomised control trial. There was a reduction in the severity of cough in 87% of patients. In 2011, Patel *et al* [21] reported a significant reduction in the severity of cough, with a physiotherapy-led intervention, but this study did not include a control group for comparison. Patel *et al* [21] reported 70% of patients had an improvement in health status with PSALTI greater than the minimal clinically important difference of the Leicester Cough Questionnaire [4]. Recently, Chamberlain-Mitchell *et al* [18] evaluated PSALTI in chronic refractory cough in a randomised controlled trial. This was a multi-centre trial that comprised both secondary care and tertiary care sites. The therapy was delivered by either a specialist physiotherapist or a speech therapist. Patients underwent weekly sessions over four weeks. The control intervention was healthy lifestyle advice that

was delivered in a similar number of sessions, to ensure that patients received equal attention. The primary outcome measure was health-related quality of life assessed with the validated Leicester Cough Questionnaire [18]. Secondary outcomes included cough frequency measured with the validated Leicester Cough Monitor and capsaicin cough reflex sensitivity [22]. PSALTI was associated with a clinically significant improvement in cough-specific quality of life after adjusting for changes with the control intervention. There was a 41% reduction in objective cough frequency, compared to the control intervention; this was considered clinically significant [18]. There was a significant reduction in cough reflex sensitivity with PSALTI, but this was not significant after adjusting for the reduction with the control intervention. An important observation from this trial was that improvement in cough with PSALTI was sustained following completion of therapy at a three-month follow-up visit. The key strengths of this trial were that it was multi-centre, multi-disciplinary, inclusion of specialist and non-specialist centres and the use of validated objective and subjective cough end-points. There were no side effects associated with therapy.

## **2.2 How Does It Work?**

The mechanism of action of PSALTI is not known. Recent functional-MRI brain studies have reported dysfunctional inhibitory control in patients with CHS [9]. One explanation could be that by practicing cough suppression techniques, patients restore their control over cough. In a post-hoc analysis of PSALTI trial reported by Chamberlain Mitchell S *et al* [24], patients with evidence of dysfunctional breathing at baseline responded best to PSALTI. Dysfunctional breathing patterns, if present, may dehydrate and irritate the larynx and activate cough receptors. Therefore breathing exercises may reduce the stimulus to cough. PSALTI also reduces the sensitivity of the cough reflex [25]. This is likely to be a

consequence of the interventions and also due to breaking the cycle of cough exacerbating further coughing. It is noteworthy that the lifestyle interventions used as control therapy in clinical trials had a beneficial effect in reducing cough [18]. Lifestyle advice to reduce stress and anxiety is an important component of PSALTI therapy. The efficacy of PSALTI therefore is likely to be greater than that reported in trials since it was compared to an active intervention, rather than a true placebo.

### **2.3 Patient Selection**

Clinical trials of PSALTI have typically included patients with a chronic, refractory cough. These are patients who have undergone detailed investigations and trials of treatment for associated aggravants, such as asthma, gastro-oesophageal reflux disease and rhinitis. There are currently no investigations available that diagnose CHS. The clinical profile of patients is helpful. They are more likely to be female with an onset of cough between age 40 to 60 years old [26]. Patients usually have a dry or minimally productive cough. A detailed cough symptom history is helpful. Cough may triggered by typical tussive stimuli, such as strong odours (hypertussia) and non-tussive stimuli, such as talking, laughing and easting certain foods (allotussia) [27]. Most patients report a sensation of the urge to cough sensation. Abnormal laryngeal sensations are common such a tickly throat (laryngeal paraesthesia) [27]. The Cough Hypersensitivity Questionnaire (CHQ) records the triggers of cough and associated symptoms [28]. Further studies are needed to investigate its potential to identify patients who improve with PSALTI. The Newcastle Laryngeal Hypersensitivity Questionnaire, although developed for patients with Laryngeal Hypersensitivity, is another tool that deserves further study since many patients with Laryngeal Hypersensitivity present with cough [29].



## **2.4 Adherence**

Adherence is discussed during each PSALTI session and patients are encouraged to be compliant with therapy. The adherence to PSALTI in previous trials is not known. There is no gold standard outcome measure of self-reported adherence [23]. Cough physiotherapy is a complex intervention, where measuring adherence to each specific component is unattainable. For specific interventions, such as breathing retraining or vocal cord exercises, patients can simply record the frequency and duration of doing these exercises. However, the poor validity of such an approach needs to be acknowledged. Therefore, rather than asking patients to measure their adherence with the intervention, it may be more advantageous to ask patients to keep diaries to document the impact of the therapy on their symptom. This approach may help motivate patients to be more adherent with the therapy.

## **2.5 Who Should Deliver PSALTI?**

PSALTI has been delivered by either Speech and Language or Voice Therapists or Physiotherapists. There is evidence to support the efficacy of cough suppression interventions delivered by either therapist [20,21]. The PSALTI trial included centres that delivered speech and physiotherapy led interventions [18]. There was no effect of either the type of therapist or centre on the efficacy of PSALTI [18]. It is important that therapists receive training in cough suppression, and that they follow a standardised protocol. The choice of therapist is likely to be dictated by their availability locally. It is important that Physiotherapists and Speech Therapists work together to improve the availability of this therapy and to achieve the common goal of improving the quality of life of patients with cough. The development of treatment guidelines, patient information leaflets and creation of specialist therapist interest support groups may facilitate this.

## 2.6 Cost Of Therapy

At King's College Hospital London, the cost of PSALTI is £323.28 per patient in 2017 (4 out-patient sessions). This compares favourably with an alternative therapy for refractory chronic cough, Gabapentin [11]. At King's College Hospital, the cost of a 3-month trial of Gabapentin in 2017 is £471.42 per patient (1800 mg dose per day and 3 out-patient clinic visits for initiation and supervision). The cost of therapies for refractory chronic cough is likely to vary according to the health care setting and country. It is important to determine the cost-effectiveness of PSALTI using validated methods in future studies.

## 2.7 Combination With Drug Therapy

A recent trial by Vertigan *et al* [12] reported that the combination of speech therapy with neuromodulator drug therapy Pregabalin was associated with greater improvements in cough. There was a significantly greater increase in cough-specific quality of life in patients receiving speech therapy plus Pregabalin therapy compared to speech therapy alone. Importantly, the benefit of this combination therapy was sustained following its discontinuation when assessed at four months. Further studies are needed to investigate the efficacy of PSALTI when combined with other anti-tussive therapies such as MK7264, a peripherally acting inhibitor of sensory nerve receptor P2X3 currently in clinical trials.

## 3. Conclusion

There is good quality evidence from randomised control trials to support the use of PSALTI in patients with Cough Hypersensitivity Syndrome. PSALTI reduces the frequency of cough, significantly improves quality of life and is associated with few or no side effects. When

combined with neuromodulator drug therapy, it is associated with greater improvements in cough. Further studies are needed to determine the components of PSALTI that are most effective, and also its cost-effectiveness. PSALTI can be delivered by either speech or physiotherapists. There is a need train therapists in PSALTI and to promote its utility amongst clinicians treating patients with cough. CHS can coexist with other chronic respiratory disorders such as asthma, chronic obstructive pulmonary disease, idiopathic pulmonary fibrosis and sarcoidosis and therefore the efficacy of PSALTI should be investigated in a wider context of patients suffering from a persistent cough.

**Table 1. PSALTI components**

<b>PSALTI component</b>	<b>Technique</b>
<b>Education</b>	Educate patients on chronic cough and cough reflex hypersensitivity. Explain the negative effects of repeated coughing Educate patients on voluntary control of cough
<b>Laryngeal hygiene and hydration</b>	Increase frequency and volume of water and non-caffeinated drinks Reduce caffeine and alcohol intake Promote nasal breathing
<b>Cough control</b>	Teach patients to identify their cough triggers Teach patients to use cough suppression or distraction techniques at the first sign or sensation of the need or urge to cough. These cough suppression/distraction techniques include: forced swallow, sipping water and sucking sweets. Teach patients breathing exercises: breathing pattern re-education promoting relaxed abdominal breathing pattern technique; pursed lip breathing to use to control cough.
<b>Psycho-educational counselling</b>	Motivate patients, reiterate the techniques and the aims of therapy Behaviour modification: to try to reduce over-awareness of the need to cough Stress and anxiety management

Modified from Chamberlain-Mitchell *et al* [18]

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